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The
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EDITORIAL

WINSTON TAKES OVER

With this issue I vacate the Editorial Chair. It has for me been an enjoyable session. There have been moments when it might have been uncomfortable, for the policy of the Bulletin has been to allow all shades of opinion to speak their minds. Some members have taken advantage of the opportunity, and others have sometimes resented criticism. They alone, I am sure, are pleased that our first Editor, Stanley Middlebrook, has ceased to write his Diary.

Middlebrook's Diary had become an institution. Most readers turned to it first, and only those who did not know the warm humanity of the Diarist were really offended at his outrageous sallies. No wonder, then, that when he announced The End I was bombarded with telegrams and letters urging me to demand a change of mind.

But have *you* ever tried to change Middlebrook's mind ? The story goes that when he invested in a tape machine in order to possess a permanent record of discussions with " doctors, pundits and others," their words of advice were invariably drowned by his forceful protests—when he allowed them to interject, that is !

Mr. Alderton has been equally unsuccessful in his attempts at persuasion, and seeks another Diarist. But does one exist, with such experience, such facility with the pen, such a sense of humour—and such audacity ?

The task of an Editor is not a simple one. Most growers are fearful of committing their ideas to publication. It has been hard labour to persuade anyone to write for that important series, " My Way of Growing," for example. On the other hand the Sundriesmen, more surprisingly, have to be pressed to take advantage of the free publicity afforded for their new tools by " Seen This ?"

The success of the *MGA Bulletin* has been due to the contributions of a minority who agree to write for its pages, and the Editorial Board thanks them warmly. At the same time the Board wishes to say a special Thank You to the loyal **Advertisers,** who not only keep the Mushroom Industry informed of the wide range of facilities which are available, but make possible the monthly distribution of a publication which is read and praised throughout the Mushroom World.

Here's the Chair, Mr. Alderton. May you occupy it for many years, adding to its prestige and spreading enlightenment among growers who, just now, are very much in need of it !

Fred C. Atkins.

YAXLEY'S PROGRAMME

by Dr. R. L. EDWARDS

When the Yaxley Research Station was set up in 1946, there was only one major item on its programme—development of a synthetic compost which would give yields equal to those from good horse manure. Work on that problem occupied practically all the staff for the first three years of the Station's existence, and led to the publication in 1949 of the formula which is now in use on a number of farms where it has completely replaced horse manure.

Some work on compost continued into 1949 and 1950, and a start was made on some disease problems, particularly Truffle and Bacterial Pit. A partial control of Truffle has been obtained by the use of copper sulphate solution sprayed into the finished compost. Under favourable conditions, particularly when the temperature is kept below 75° F., this greatly retards the growth of Truffle and, rather surprisingly, does not injure the mushroom. Although the use of copper sulphate was introduced for control of Truffle, it has also been found quite effective against the yellow moulds which invade many composts.

Attempts to control Bacterial Pit by a wide variety of spray treatments have been unsuccessful, although some have appeared to show promise in single trials, only to fail when the work was repeated. This work is made more difficult because the disease cannot be reproduced at will, and all experiments have been made on commercial beds late in their cropping period. Efforts are still being made to produce the disease by deliberate infection at the Research Station, so that experiments on its control can be planned with reasonable certainty that the disease will appear. So far this has not been achieved. Meanwhile the bacteria found in the pits characteristic of the disease are being studied. There is one other disease (or group of diseases) under investigation, "Verdigris," "Mat Disease," *Myceliophthora*, or as we now prefer to call it "Yellow Mould." There are several characteristic yellow fungi which are commonly found in mushroom beds, either scattered through the compost or in a layer between compost and casing, and are blamed for loss of crop. One of them is *Myceliophthora lutea*, and another is probably *Myceliophthora sulphurea*, but others differ from the established descriptions of these two species in various respects, such as colour, shape and size of spores, and it is not yet clear whether there are variations within the species wide enough to include all the fungi found, or whether there are still other species present. There is a tendency for only one fungus of the group to occur on any one farm. At present the identity of some of these fungi is uncertain, and so is their effect on cropping. In some cases their presence is clearly associated with crop failures, although these could be due to other causes, and in other cases good crops have been picked from beds quite heavily infected with a fungus of this group.

A collection of these fungi is being made, including specimens from abroad. The work is complicated by the fact that some of them are not easy to grow under laboratory conditions, nor to introduce into experimental mushroom beds. It will be necessary to do this with each of these fungi separately to establish which of them are harmful, what conditions favour their growth, and how they can be controlled. That will be a long and difficult piece of research, and will keep us occupied for a considerable time to come.

The other main subject of research now in progress is casing soil. This work is based on a study of the physical properties of a few soils and of artificial mixtures made up with peat, sand and Vermiculite. The particular properties now being studied are Moisture Holding Capacity and Pore Space, in the wet and dry material. Peat is an important tool in making up artificial mixtures to give a wide range of these properties, and as little was known about the behaviour of peat in these respects, quite a lot of time is being devoted to a study of peat itself. At the same time cropping experiments are in progress to compare results from mixtures made up to give a graded series of physical properties.

Some of these mixtures have already found commercial use on an empirical basis, but if the programme is successful it should be possible to lay down the requirements of a good casing material in terms of Moisture Holding Capacity, Pore Space, etc., so that the performance of a new material or mixture can be predicted from laboratory tests instead of, as at present, having to rely on a practical cropping trial.

Apart from this formal programme of research on disease and casing soil, the staff of the Research Station naturally take a lively interest in many other problems. We accumulate information which sometimes gives a useful insight into problems of mushroom growing without carrying out any experimental work; for example, the results of a survey carried out two years ago have thrown new light on the incidence of some common diseases.

The Research Station has given advice, reports on disease, etc., to its subscribers ever since 1946, and this service helps to keep the staff in touch with commercial growers' problems. The results of its work are published in Annual Reports and in articles in scientific and horticultural periodicals.

MUSHROOM SCIENCE—2

The Proceedings of the Second International Conference on Mushroom Science, held in Belgium last year, are now available from the MGA Secretary at 12/- post free. A review of this publication will appear in our June Bulletin.

LONGEVITY SECRET

Mrs. Emily Hannah Covil, of Brentfield Road, Dartford, Kent, is 101. She has given a local journalist this tip for a long life: *A good breakfast with plenty of mushrooms every day!*

Reprinted from The Grower of 12.12.53 with the Editor's permission

WE HAVE MANY USES FOR SPENT COMPOST

says

Harold G. BOXALL

A mushroom shelf unit of 18,000 square feet takes about 560 tons of manure a year, or 120 tons of straw if synthetics are used. Some glasshouse growers who put down beds only in the autumn equal this consumption of dung, and some exceed it. The total over an area like West Sussex is very considerable. After composting and taking a crop of mushrooms from it, there is turned out annually an enormous quantity of spent mushroom compost, or " spent mush," as we usually call it.

If the mushroom crop has been good, the residue is really exhausted, but if the crop has been poor, or worse still, has only bred fly larvæ, the manurial value is much higher.

There is considerable difference of opinion amongst growers as to the value of " spent mush "; some use lots of it, some won't touch it. On a holding such as ours, which is run in conjunction with 2½ acres of glass and about 6 acres of outside land, it is obviously to our advantage to find a use for it.

Our experience over the years has shown that some crops do not like " spent mush," but this dislike is only shown when the spent compost is used before it has been weathered. Cucumbers are especially allergic to newly turned out " spent mush."

Stoller recently expounded a theory on the function of casing soil which, roughly, was that mycelium gives off a hypothetical substance which inhibits the production of fruiting bodies (or buttons). The casing soil absorbs this hypothetical substance and thus enables the mushroom to grow. If there is anything in this theory, it may be the reason why newly turned out spent compost is harmful if used immediately.

The same hypothetical substance may inhibit or even destroy root growth in some plants. Whatever the reason we have found that we must weather the spent compost to be safe, unless of course you are spreading it on outside land to be ploughed in during the autumn. This, I think, is the ideal time to dress the land with this material, as it quite naturally weathers underground, loosing all its mycelium growth and improving soil structure considerably, apart from its manurial value.

Flegg, in his analysis, has shown that spent compost has a definite manurial value and that spent synthetic compost compares favourably with farmyard manure. I think the greatest value in " spent mush " is its humus value, especially on heavy land. We have found that continued applications alter the soil structure entirely. The land never bakes hard in the summer. It is never what the ploughman calls " steely," and in drought years retains moisture much longer.

Other experiments we have made showed that there are other uses for this material. We have established that it has a manurial value and a humus value. It is also completely weed-free, and we can make good use of that fact, especially in bulb or corm growing. Irises or tulips planted in the autumn love it. The land is tilled to a fine tilth, the bottom knocked out of a chitting tray and the square placed on the soil so that it then looks like a box full of fine soil. The bulbs are pressed lightly into the soil, just enough to keep them upright, the spacing being decided by marking the sides of the box. By moving the square along a line a bed is soon completed.

Saving labour

The whole is then covered with spent mushroom compost to a depth of about three inches, including the pathway between rows. The bulbs soon sprout through the compost, but nothing but deep-rooted weeds can grow, and a considerable saving in labour is achieved.

In the case of gladioli, we take out a shallow trench with the Graveley, place the corms in one line about two inches apart, and fill the trench with " spent mush."

Another experiment, yet to be proved, is a carnation bed composed of 50 per cent. spent mushroom compost and 50 per cent. ashes from the boiler.

Most fungus diseases get a hold on glasshouse plants because the plant is a little off colour, causing it to lose its natural protective power. This indisposition can easily be caused by the loss of only a small number of roots near the soil surface due to drying out. If a deep mulch is put down to ensure this does not happen, we find the incidence of such troubles as cladosporium and mildew is checked.

Top feed with potash

By planting tomatoes in a shallow trench and filling it with well weathered, spent mushroom compost, no drying of the surface can take place. We have employed this method now for four years and find no ill effect. We top feed with potash only, but do not grow a roof crop.

Some growers make a practice of adding considerable quantities of BHC with their compost to keep out the fly, and after this year's infestation this practice is likely to increase. If the spent compost, so treated, is spread on land used to grow root crops, especially potatoes, tainting will occur. So to any would-be purchaser of spent mushroom compost who intends to use it on potatoes or other roots, I offer this word of warning. Inquire if BHC has been used in the compost. Quite accidentally we planted potatoes this year on land dressed with BHC impregnated spent compost three years ago, and there is still a slight tainting.

What is a disadvantage for roots is an advantage for other crops, because the BHC will kill wireworms and cabbage root fly maggot. To the nurseryman who grows chrysanthemums or cauliflower, therefore, spent compost with BHC is an extremely useful commodity.

DUTCH ASSOCIATION

Efforts over the past few years to create an association of mushroom growers in Holland have resulted in the formation of ANCV. We understand that some of the growers there, as in Britain, do not realize the advantages of membership. In Holland, also, the individual grower cannot protect himself against government interference in the same way as a recognised national association can.

ANCV is modelled on the MGA, and is already publishing a journal, but the subscription basis is different. The smaller growers should be encouraged to join by a sliding scale related to the quantity of manure used annually. For growers using not more than 50 tons of manure a year, the subscription is 15 guilders (£1 10s.), 50-200 tons a year, 25 guilders (£2 10s.), 200 tons a year or more, 50 guilders (£5).

The MGA wishes every success to its newborn cousin across the sea.

THE THIN-BED THEORY

The last two Bulletins have discussed W. S. GALBRAITH'S theory on Thin Beds. This month Dr. R. L. Edwards has more to say:

Mr. Galbraith may wish to include me among those lacking intelligence, for I admit that I cannot follow the first half of his latest contribution.

On the cost of spawn, which he considers very involved, I merely repeat the question I asked before, " Does Mr. Galbraith really use only half as much spawn per 1,000 sq. ft. in beds of half depth?"

Regarding his Table 1, the last column should be headed " Profit p.a. per Ton-crop," not " per Ton per crop," because it takes account of the number of crops per annum, and gives the profit from x tons of manure, where x crops a year are being grown.

Apart from that I am glad to see his admission that on the figures in that Table, the thin bed man is down on the deal even in the case most favourable to him.

Now he carries the argument further in Table 2 by introducing more crops a year and shallower beds, but omits any figures for yield.

Really Mr. Galbraith!

The answer to the question in his last paragraph, "Would his profits be greater than John Smith's?" is that it depends on the selling price of mushrooms, a fact which I have pointed out before. On the figures given in that paragraph, if the selling price were over 5/6d. per lb., his extra ½ lb. per sq. ft. *is* profitable even when the higher yield has to carry the enormous burden of 67% higher cost of production.

Of course this price is not being realised now, and I mention it only to emphasise that comparisons of profit between farms with different costs of production must also take selling price into account, even when it is the same for both of them.

Anyone who has an *annual* output per sq. ft. of 1·5 or 2 lb. per sq. ft. is inefficient by modern standards. The annual output takes account of the number of crops a year, for example 1·5 lb. sq. ft. five times gives a bigger total than 2 lb. sq. ft. three times. Output per ton of manure is no more helpful unless it is related to the quantity of manure used on a given farm in the year.

It is liable to be very misleading in other ways: for example, one grower may buy heavy manure containing 75% moisture: another buys racing stable manure with only 50% moisture— I am not exaggerating for both these levels of moisture do occur. The first grower must buy four tons of manure to obtain one ton of solid food material, the second only buys two tons. And the second should add an equal weight of water to his manure when he stacks it, making two tons of manure for about the price of one. Which weight would Mr. Galbraith use to calculate his yield? A commodity as variable as that does not seem a very good yardstick to me.

In fact there is no real substitute for annual profit.

What is the next best thing may be a matter of opinion. Mine is that output per sq. ft. bed area per year is the best guide.

W. S. Galbraith has the last word . . .

As this discussion seems in danger of out-living its utility, I propose to close the "case for the defence" herewith.

Firstly, a few comparative yield figures obtained from my plants here recently. These are not flower-pot experiments, but commercial crops grown separately in small shelf-bed houses or in groups of outdoor frames. No invidious selecting has been done. The averages shown are derived from *all* crops completed in the period up-to-date, excepting 7 "duds" (four thin and three thick) which averaged ·4 lb. sq. ft., and failed for reasons unrelated to the present subject, (e.g., diseased soil, unorthodox short composting experiments, one complete wipe-out of spawn run by Cecids, and two of grain spawn by mice boring into a heat house). About 80% of *all* the 32 crops had Cecids and

Vert-de-Gris, and, apart from the failures, several were affected also by the batch of diseased soil, and the unknown inclusion of pig manure in one source of supply.

12 Thin Beds (Picked to max. of 8 weeks = 4 crops p.a.)
Average Depth 4·1″
„ Yield 1·09 lb./sq. ft. (4/5ths. Potential, = 1 lb.)
233 lb./ton @ 4½″

7 Medium Beds (Picked to max. of 10 weeks = 3½ Crops p.a.)
Average Depth 5·2″
„ Yield 1·29 lb./sq. ft. (4/5ths. Pot'l. = 1.17 lb.)
205 lb./ton @ 5½″)

6 Thick Beds (Picked for total useful life, average = 10·4 weeks
Average Depth 7·7″ Max. = 13 weeks)
„ Yield 1·65 lb./sq. ft. (4/5ths. Pot'l. = 1.6 lb.)
179 lb./ton @ 9″)

Any of the Thin Beds which still showed life at 8 weeks were given extra time (up to 12 weeks). The total extra yield was only ·1 lb./sq. ft. Similarly, the Mediums gave ·042 in the same maximum extra time. The thinnest bed (3″) ran 5 weeks to give ·86 lb./sq. ft. (212 lb./ton)—well above its rated 4/5ths potential and its 5 crops p.a. rate.

The figures are not startling, but they are above Table 1's forecasts for 4/5ths potentials. Produced as they were during a difficult period of staff changes, and a partial move-in to new premises with a hot-air plant giving teething troubles of its own, they are above my expectations, and will, at least, provide some *actual* yields (on my word only!) to take the place of the theoretical yields which Dr. Edwards seems to miss in Table 2. Why he should miss them, I do not know, as a footnote to that Table stated that it was based on the figures of Table 1; which, of course, indicated the use once more of the Yield Reduction Factors derived from Dr. Lambert's paper—actually 1·6 in the case of a bed reduced to half thickness. It seemed a little needless to tell readers to divide (for instance) a 7″ potential by 1·6 to get a theoretical 3½″, then to double the area, and thereafter multiply by 4, 5, etc., to take care of extra crops per annum. Really, Dr. Edwards, we growers—clods of clay as we may seem to you—mostly managed to stagger through our primary-school arithmetic—E. & O. E.! Moreover (in reference to your lb./per ton comments) most of us have personally done enough " muck forkin' " to be able to form a pretty shrewd idea how the other fellow is getting along if he tells us that he has bought " 100 tun o' dung " (" strawy," " medium " or " 'eavy ") and averaged 200 lb. per ton off it. For we know (perhaps intuitively) that that extra 5 cwts. of water (mostly urine) which so worries you is really much less important than *the conditions which make its presence possible*. Original " dry matter " is *not* " solid food material " until men, or horses, have made it so; and the horses have already had a much larger hand in the job where " heavy " manure is concerned. To quote your own words of long ago, " He probably does it more consistently than ever we shall " . . . . . . but all this is part of another story.

Now for Dr. Edwards's other points which seem to demand an answer:

Spawn. My answer is YES—use (especially with grain) double spawn for double bed-thickness, per unit area.

Profit per annum " Per One Ton Per Crop " or " Per Ton-Crop." Both mean the same—take your choice. The meaning was clearly explained in both my earlier articles.

John Smith v. Self. Here Dr. Edwards indulges simultaneously in two metaphorical exercises—and in the process, falls headlong into the " lb per sq. ft." trap of which I warned, splitting hairs, and trailing red herrings as he goes.

Most readers, I think, will have taken the " annual certified " figures of 2 lb. and 1·5 lb. as being the averages of the year's crops. Dr. Edwards has taken them as annual *totals* per sq. foot of growing-house bed space. This implies that Smith and I have grown only *one* crop p.a. at these figures—hardly efficient, I admit!—or that we have grown (say) four crops each, at the miserable respective averages of ·375 and ·5 lb./sq. ft. See how confusing this " lb. per sq. ft." business is unless *everything* is known? Stick to it for a moment, however, while we examine Dr. Edwards's newly introduced factor of Selling Price. Stick also to the wide difference in costs, and to Dr. Edwards's fanciful 5/6d. per lb. selling price, and we should get something like this—in great detail this time!

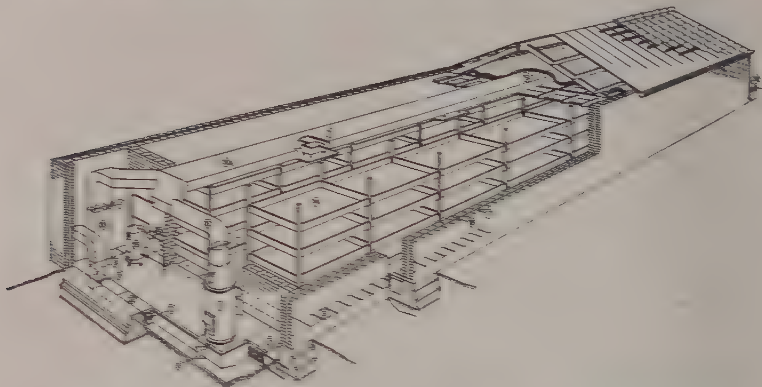
	Crops Per Annum	Yield lb./sq. ft. Average of Year's Crops	Yield p.a. lb. per sq. ft. *	Selling Price	Revenue p.a. per sq. ft. *	Production Cost per lb.	Production Cost p.a.	Profit p.a. *
SMITH (thin beds)	4	1·5	6	5/6d.	33/0d.	1/6d.	9/0d.	24/0d.
SELF (thick beds)	2	2·0	4	5/6d.	22/0d.	2/6d.	10/0d.	12/0d.

Even if the selling price was £1 per lb. Smith would still make £5.11.0 as against my £3.10.0. Even if our costs were the same, Smith still scores. Dr. Edwards remarks that crops per annum determine the results, but fails to note that *it is Smith's thin beds which have given him the extra crops and profit*. Only when Smith slows down his cycles to my speed does my extra ½ lb. bring me level with him—at 5/6d. per lb. Above that price I gain—if Smith is foolish enough to grow only two crops p.a. with his thin beds.

*From each square foot of growing-room bed area.

This controversy must now cease in our columns. Anyone interested in pursuing it is invited by Mr. Galbraith to write to him.—EDITOR.

A DUTCH AIR-CONDITIONED HOUSE



The diagram shows the layout of a Dutch air-conditioned mushroom house.* The various parts of the heating and cooling system are numbered as follows:

1. Hot air stove.
2. Fan.
3. Deep well water cooler.
4. Air-flow regulator.
5. Recirculation control shutter.
6. Heating or cooling circuit selector shutter.
7. Air-flow regulator.
8. Return-air outlet for heating, or air inlet for cooling circuit.
9. Fresh-air inlet.
10. Hot-air inlet-duct from stove.

10a. Hot-air distribution-duct or return-air duct for cooling circuit.

11. Hot-air inlet to house.
12. Return-air or fresh-air duct to stove or cooler.
13. Return-air duct for cooling circuit.
14. Shelves.
15. Boiler for humidification.
16. Boiler water level control.
17. Brick wall.
18. Insulated wall.
19. Insulation.
20. Air-outlet.

Air circulation is provided by the fan (2) and its speed is adjusted by the air flow regulators (4) and (7).

Air can be recirculated or fresh air can be drawn in, the proportion of fresh to recirculated air being controlled by the shutter (5).

*Reproduced with permission from JAARVERSLAG, 1959 (Annual Report of the Institute of Horticultural Engineering, Wageningen).

Heat is supplied by a hot-air stove (1) which heats air passing through it into the duct (19). (Flue gases do not mix with the air.) Heating the air dries it, and it is rehumidified to a controlled degree by means of steam from the boiler (15), which discharges into the warm air duct (19a). The air then passes through the inlets (11) which are distributed along the house and are baffled to avoid blowing draughts directly on to the adjacent beds. Air is drawn from the house into ducts under the floor (9) from which any desired amount can be taken for recirculation through the shutter (5) and duct (12). The unwanted air is discharged at the outlet (20).

In warm weather the air can be cooled, with controlled recirculation and admission of fresh air in the same way, but the circuit through the house is reversed. Incoming and recirculated air from the fan (2) passes through the cooler (3) which has a radiator cooled by deep well water. It passes along the duct (8), up into the house, and is drawn out through the openings (11) into the duct (19a), through the regulator (4) and duct (13) to the fresh air inlet recirculation control shutter (5).

The selector shutter (6) determines which circuit is used by admitting air from the fan either to the hot air stove or to the cooler. If neither heating nor cooling is needed the air can be circulated and renewed as desired without being either heated or cooled.

WHO'S WHO?

Dr. Helmut Rempe is Director of the Mushroom Research Department of the German Research Association for Hothouse and Hydro Cultivation in Essen. He was born in 1912 at Dortmund and after secondary education at Detmold studied Natural Sciences from 1930 to 1936 at Bonn, Innsbruck and Göttingen Universities, gaining his Doctorate degree in Botany in 1937.

He occupied posts as peat and moor specialist with several local authorities until 1941, when he went to serve with the German Army, exclusively in Russia until wounded in East Prussia. He was discharged from hospital in August, 1945. Until 1950, he was employed as seed cultivator for the largest German hothouse installation at Weissmoor. In Essen in 1950, he succumbed to the serious Mushroom Disease "for which no cure is possible". He has been engaged in mushroom research ever since.

Dr. Rempe has written us an article on his work in Essen. It will appear in our next issue.

PEAT CASINGS

SOME OBSERVATIONS ON THEIR USE AND MERITS

by Dr. R. L. EDWARDS

The use of peat and peat mixtures for casing has made one of the biggest impressions ever known in the mushroom industry in this country. It is therefore not surprising that there is a great demand for information, much of which does not exist. There are many mistaken ideas, a substantial commercial interest has developed in the supply of various types of peat, and new problems have arisen with the use of these new materials.

The purpose of this article is to answer some of the questions arising from the use of peat, without repeating what has been published elsewhere. The time is not yet ripe for a full account of the whole subject: there are too many gaps which cannot be filled.

There are two main types, sedge peat and sphagnum or moss peat, with a variety of grades in each type.

There are also two chief ways in which peat is used for casing:

1. plain peat.

2. peat mixed with lump chalk, sand, ashes, or Vermiculite, in varying proportions.

In all cases the peat must be neutralised with chalk or lime in some form.

Naturally the first questions asked are which is the best type and grade of peat, what should be mixed with it, if anything, and how should it be used?

In my opinion a general answer to those questions does not exist and never will, for these reasons. The effect of any casing depends partly on the air conditions over it, and these vary from farm to farm and from time to time, particularly in being dry in winter and more humid in summer. Therefore "one man's meat is another man's poison." Also watering treatment can vary and the best watering for one casing may not be best for another.

Certainly several mixtures of peat and sand, peat and Vermiculite, peat and chalk, and also some kinds of peat used alone, are capable of giving good yields in suitable houses and under suitable management.

It would be better for growers, rather than seeking a largely fictitious "best" casing, to choose one (or two at most) and concentrate on learning how to get the best results with that.

Reliable information on which to base this first choice is scanty. Although bold claims have been made on behalf of various types and grades of peat, *I know of no published figures giving the yields from trials in which different peats have been compared, to justify any claim that one peat is better than another: nor have any such figures been shown to me privately.*

I must add that it is not the function of the Research Station to compare proprietary brands of peat; when we do compare peats it will be on the basis of type and grade, but for the present that too is outside our programme.

The development of peat casings by the Research Station has been aptly described as a by-product of its programme of research on casing soil; the object of this programme is to study the relation between physical properties of casing materials and mushroom yield. When peat mixtures were used as a means of varying these physical properties, it was found that some of them gave excellent yields, but that was and still is incidental to the main programme.

The factors to consider in choosing a casing of this type are:

Cost per square foot of bed, making sure that sufficient depth is used. Our experience suggests that over 1½ inches are needed for best results.

Grounds for thinking that it is capable of giving good yields, which should be based on results at the Research Station or on commercial farms; definite figures should be asked for, but comparisons between one farm and another are not reliable for this purpose.

Very fine, dusty peat should not be used.

Management

The use of peat casings does not make it easier to grow consistently good crops: the reverse may even be true. It is harder to judge the amount of water in a peat casing, and to water always to the same degree of wetness, than with soil. We do not yet know at what points peat becomes so wet or so dry that crops suffer. Although peat can hold enough water to last a week or more, we think it is unwise to rely on this, and peat casings should be watered much more often, giving two, three or even more light waterings a week, unless this stains the mushrooms as it sometimes does.

Peat is said to be sterile. Although it does not usually introduce a lot of pests and diseases *it is not sterile*, and could carry organisms which have survived in the original peat or have been picked up since it was cut. There have been various reports of disease alleged to be introduced with peat, but it is very difficult to be sure whether they are due to original infection or accidental contamination of the peat, or to favourable conditions created by its use on the bed. For example, peat casings are often kept wetter than soil would be, and this is quite probably desirable, but it does tend to favour growth of bacteria, eelworms and possibly other pests and fungi.

So that although peat and its mixtures open up new prospects of higher yields with greater convenience and less labour, they bring their problems too, and may even make greater demands than before on the skill of the grower.

FIRST STEPS IN GROWING

by
McGregor Bulloch

5—FURTHER DETAILS OF LAYOUT

In No. 3 of this series it was pointed out as one of the disadvantages of tray-growing that one cannot inspect each house at a glance as one can if shelves are used. This is, of course, because the trays are stacked in open brickwork fashion, thus cutting out bed supports, with a consequent saving in labour and material when constructing the houses. I would like to mention here that trays can be mounted side-by-side in tiers on a simple framework so that when filled into the house, they are almost equivalent to shelf beds. In this way, one of the main disadvantages of trays is overcome, and there is the added advantage of an uninterrupted air flow over the growing surface. Quite a number of growers are adapting their houses in this way.

To resume the considerations of layout details, one of the most important needs of a mushroom farm is a good water supply of medium to high pressure, with all exposed pipes lagged efficiently. Nothing is more irritating than a low pressure main, or a supply which relies on a small reservoir liable to be dried up by drought. The latter can lead to the complete failure of a crop in hot weather, so a reliable water supply must be provided at the outset. A stand-pipe should be arranged *inside* each cropping shed, and one in or near the peak heat rooms if the farm is on trays. All hose connections should be standardized, so that any hose will fit any tap. A $\frac{3}{4}''$ internal diameter hose will be found the most practical size to use.

Equally important is concrete or stone flooring in the cropping sheds and composting shed, and concrete surrounds and paths in all working areas. It is expensive, but how it improves working conditions and hygiene! With careful planning, the cost of concreting can be reduced by using shallower layers where heavy loads are not expected. It may not be easy to find the money however, but if at all possible, some concrete should be put down, and assuming that the floors of the growing sheds are already concreted, the composting shed should be first on the list. With a concrete floor it is an easy matter to clean and sterilize between stacks, whereas a porous floor will lead to a build-up of disease. As money becomes available, concrete paths or roads should be laid wherever there is constant daily traffiic, such as between composting shed and growing sheds, and in a line connecting the doors of the growing sheds in order to avoid carrying dirt etc. around when going from shed to shed.

It has already been mentioned that light is not necessary for mushroom-growing, and that direct sunlight discolours cultivated mushrooms. It is up to the grower whether he instals windows or not. These will be at the ends of the sheds, and should have wooden shutters arranged to cover them when the direct sunlight hits the beds, or when peak-heating. There is no doubt that if windows are allowed for, the light they give is useful, when watering for example, since the light scatters sufficiently to enable one to see what one is doing, especially if the interior walls are of a light colour.

Great attention should be paid to the surface of the floors of growing rooms and peak heat rooms where trays are used. Unless they are smooth and even, a lot of trouble will occur in stacking the trays and occasionally disaster in the form of the collapse of a leaning row of trays. Although trays are usually stacked on wooden blocks to keep them off the cold and sometimes wet floor, a worthwhile refinement which helps in speed of filling is to arrange a permanent set of concrete ridges along the length of the growing rooms, at such spacing as to take the place of blocks. Since fish-trays are placed in double rows where possible, the central concrete ridge supporting the double row will be slightly wider than the outer two, since there are two box edges to support. A smooth floor surface will prevent pockets of water and dirt collecting, and with a slight fall to a drain in the centre or at the end, the floors will be self-draining at all times.

Use can always be found for auxiliary buildings on a mushroom farm, but these are best dealt with after the farm is in production and self-supporting. Two buildings are necessary from the beginning however. Firstly, a store for soil or peat, not just a lean-to or roof on corner posts. Casing material *must* be protected from air-borne contamination. A great deal of trouble is taken to compost manure and then cure it by peak-heating, which also helps to eliminate the majority of competitive moulds, and the compost is then spawned with spawn produced under the most rigidly-controlled hygienic conditions. Why invite trouble by using as a casing material something which is lying exposed to all manner of fungus and insect contamination?

One can frequently see open soil-stores used by growers who either use soil purposely taken from several feet below the top-soil where it is reasonably sterile, or who sterilize their soil where only a surface soil is available. A closed soil store will at least reduce the chances of contamination. A concrete floor is essential, and there should be no access for surface water between walls and floor, otherwise the casing material, be it peat or soil, may be contaminated by such crop-destroying pests as the nematode or eelworm, minute thread-like creatures which need only a film of water on the floor for their locomotion. Since there are a number of different host plants for the eelworm, the danger is quite common.

Secondly, a packing-shed is needed, where the mushrooms are graded and packed for the market, and some provision for storing the chip-baskets.

THE FRED. ATKINS ALPHABET—E

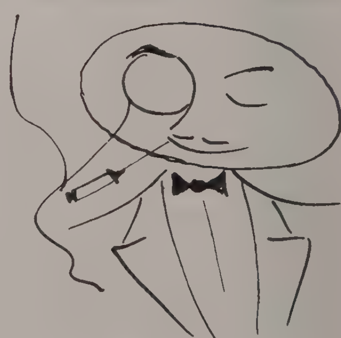
Eelworms. There is no doubt that eelworms have been pests of mushroom beds for many years, but their seriousness has become apparent only with the growing awareness of their potentialities in the horticultural world and the eradication by modern insecticides of other pests which were more readily seen and blamed. It seems that opinion to-day is that some eelworms or nematodes like *Ditylenchus spp*. destroy the spawn by sucking the food out of it, and that others, such as *Rhabditis spp*., secrete a toxic substance which breaks down the tissue of the mycelium. Sarazin has made an important observation, that rapidly growing spawn, in compost of normal moisture content, is antagonistic to eelworms, and that it is only when cropping starts that the eelworms can launch their attack.

Electricity. Electricity is an expensive means of heating mushroom houses; but does it really dry the air too much, as some believe? Mr. A. E. Canham, of the Electrical Research Association, says: " It is not so much a matter of quantity of heat supplied, which would in any case be similar in an electrical or hot-water system, but in the quantity of heat supplied per unit area of heater surface. In the case of standard tubular heaters, this is about twice as much as with hot-water pipes, and this higher surface temperature is likely to result in local drying of the air near the heaters, and not so much the whole mass of air in the building." Dr. R. L. Edwards adds: " It is the dryness of the air passing over the casing soil which matters. High surface temperature of the heaters means high radiation of heat. Normally, with heaters near the floor, only the side boards of the bottom shelves are likely to be affected."

A FARM WALK has been arranged for members of the MGA at LINDFIELD NURSERIES LTD., Lindfield, near Haywards Heath, on Saturday, 19th June, by kind permission of Messrs. FILMER.

MAC'S MUSHROOM FAMILY

5. Herr Rudolf Pilz



W. H. MAWBY discusses . . .

MALATHON

Although a choline esterase depressant by virtue of it being an organo-phosphorus compound, the active ingredient of Malathon is 100 times less toxic to mammals than Parathion.

This statement by Dr. Lloyd W. Hazleton and co-workers in America and their other findings on the pharmacology and toxicology of Malathon have been universally accepted.

Bearing in mind the fact that Malathon is a choline esterase depressant, and that the effect of its absorption will be additive to that of other organo-phosphorus compounds, Malathon is one of the safest insecticides to use.

Recent figures given by Hazleton of the Acute Oral Approximate LD_{50} of fairly well-known insecticides against rats, clearly demonstrate this. The figures show the number of milligrammes per kilogramme of body weight, the lowest figures representing the greatest toxicity.

Malathon 99% Tech.	1,845	Toxaphene	69
Chlordane	457	Aldrin	67
DDT	250	Nicotine	50-60
Pyrethrine	200	HETP	7
Lindane	125	Parathion	3
Dieldrin	87	TEPP	1.2

Application

Comprehensive tests against major pests in agriculture and horticulture in America date back to 1950, but it was not until the end of 1952 that sufficient trials had been carried out in Holland, to warrant the product receiving more attention. Full scale tests were carried out in the Channel Isles and the glass-house areas in this country with high pressure aerosols and standard formulations during 1953. These confirmed the reports received from America and Holland, and with a view to helping in the control of the flies which were becoming a major economic problem in the Worthing area, preliminary trials were carried out in mushroom houses in August which led up to full scale trials during October and November.

The problem facing the growers in the Worthing area has been described so fully by B. D. Moreton in *MGA Bull.* 50, that little can be added other than the situation on one nursery where, although the flies were present in ever increasing numbers outside of the houses, they did not appear in the houses to any great extent until after the first break-through and there were growing mushrooms in the beds. Although a very close watch was kept on the flies, no instances were reported of them attacking the mushrooms or the mycelium, but the latter faded out in the top one to two inches of the bed. Examination of the compost revealed no traces of larvae, but when the houses were emptied out, what would appear to be fully mature flies were found throughout the compost in large numbers, right to the bottom of the trays.

Tests carried out

It was felt that the first step should be an attempt to control the fly population outside of the houses, and adjacent structures and paths were first sprayed with a DNOC preparation. As this did not appear to be giving immediate control in one instance, i.e., flies were seen emerging from a recently laid cinder path which came right up to the walls of the houses, the paths were then treated with a Malathon solution, made up of 1 fluid ounce of Malathon 50% concentrate to 3 galls. of water. This can either be sprayed or sprinkled onto the paths with a watering can.

Inside the houses, the treatments were as follows:—

Preparatory to a new crop being brought in

The walls, ceiling and standing structures were sprayed with 3-4 fluid ounces of Malathon 50% concentrate and ¼ (Quarter) lb. of sugar to 1 gallon of water. These areas should be thoroughly wetted but not to run-off. It is advisable to wear a hat and old oilskin to prevent the operator getting too wet whilst doing the ceilings, and the normal routine of thoroughly washing exposed parts of the body after the application must be observed.

House where the beds were just " pipping " was treated as above, but the beds were not sprayed.

The above treated houses showed a residual toxicity of the treated areas of between 10-20 days. At the time of the treatments the fly population was not very large, and after all treatments had been carried out, the control was 100%.

House where the crop had been lost

In one instance where the crop had been lost and the trays were waiting to be emptied, control of the heavy infestation of flies was established with the low pressure aerosols based on Malathon. The effectiveness of this method of treatment was apparent after about an hour.

General remarks

When considering the possible use of Malathon in mushroom houses, the first problem was whether there would be any tainting, as the product has a strong odour which can only be described as reminiscent of the visiting card left on the privet by the old Tom from next door. Low pressure aerosols and normal spraying solutions were used over, and on the growing mushrooms. After about an hour when the odour had disappeared the mushrooms were sampled and eaten raw without any trace of off-flavour being detected or ill effects to the consumers. The use of the aerosols and spray solutions on a growing crop is not recommended other than as a drastic measure, and normally they are used up to the pin-head stage or after a clean picking of the beds.

Guided by Mr. Moreton's remarks on this problem, trials are now under way with Malathon dusts both during the last turn of the compost and dusting of the beds. The products are micronised powders and the tests being evaluated are on the basis of 2-3 lb. of dust per ton of compost, put on with a dusting machine if possible in preference to being strewn, and 3-4 ozs. dusted onto the beds per 1,000 sq. ft. of bed, or, 5-6 ozs. per 1,000 cu. ft. of space. For the dusting operations a good machine is essential, whereby it is possible with the micronised dusts to keep the products suspended for a considerable length of time.

During the various trials carried out with Malathon, no distress has been experienced by any of the operators, but for one's own comfort some plan of action should be drawn up, whereby the operator is always working away from the treated area; and an old mac with a cap when using the solutions together with a dust mask for the micronised powders are a great help.

E. H. PALFREY asks . . .

HOW EXPENSIVE IS $r = 5$?

Insulation is expensive—or so we hear. But exactly how much does it cost for insulating material to give sufficient insulation? Dr. R. L. Edwards suggested in *MGA Bull.* 18, that r should be at least 5 for outside exposed surfaces, where r is a measure of resistance a material has to the passage of heat through it.*

This article sets out to give the cost per square foot and per house (walls and roof coverage) $40' \times 15' \times 8'$ of various insulating materials of sufficient thickness to give $r = 5$. So the use of these thicknesses will mean that, with the wall or roof to (or in) which they are fixed, r will be at least 5.

Some idea of the degree of insulation provided with $r = 5$ is given by the following:—

Ministry of Housing Manual (1949) suggests $r = 5$ for the roof and walls of dwelling houses. (A plastered 11″ cavity wall has a value of 3·3).

$r = 5$ is provided by about 5″ of wood, 35″ of concrete, 40″ of solid brickwork and 60″ of stone.

In all the results shown I have assumed r values to be proportional to the thickness of the material. Further, in the results below, where several costs have been possible due to varying thickness of the material, the cheapest has been listed.

All the materials below are claimed by the manufacturers to be fungus-resistant.

**Definition of r.* A technical term C is used to describe the number of British Thermal Units which pass through one square foot of a material of given thickness in an hour when the difference in temperature between the surfaces is 1° F. r is defined as $\frac{1}{C}$. R is the value of r for a 1″ thickness.

Material	R value	$r=5$ Cost per sq. ft. (in pence)	$r=5$ Cost for house $40' \times 13' \times 8'$ to nearest £
Woodwool 3″	1·7	13·5	£83
Onazote 2″	5·0	13·5	£83
Corkboard 1″	3·6	11·2	£68
Isoflex 1″	3·1	10·4	£64
Fibreglass resin-bonded mat. Density 3 lb. per cub. ft.	4·2	7·8	£48
Fibreglass quilt 1″ medium	4·2	6·5	£40
Fibreglass bitumen quilt ¾″	4·0	6·1	£38
Alfol single sided reinforced foil type S 901KG in ¾″ airspace	*2·17	3·9	£24
Fibreglass bitumen-bonded 1″	4·0	3·8	£23
Ardor	4·8	3·5	£22
Alfol double sided reinforced foil type D 910KG in ¾″ airspace	*4·3	2·8	£17
Fibreglass 4″ house insulation	3·5	1·8	£11

*This R value is for vertical walls. For roofs the value is a little lower in winter and much higher in summer—giving correspondingly higher and lower costs.

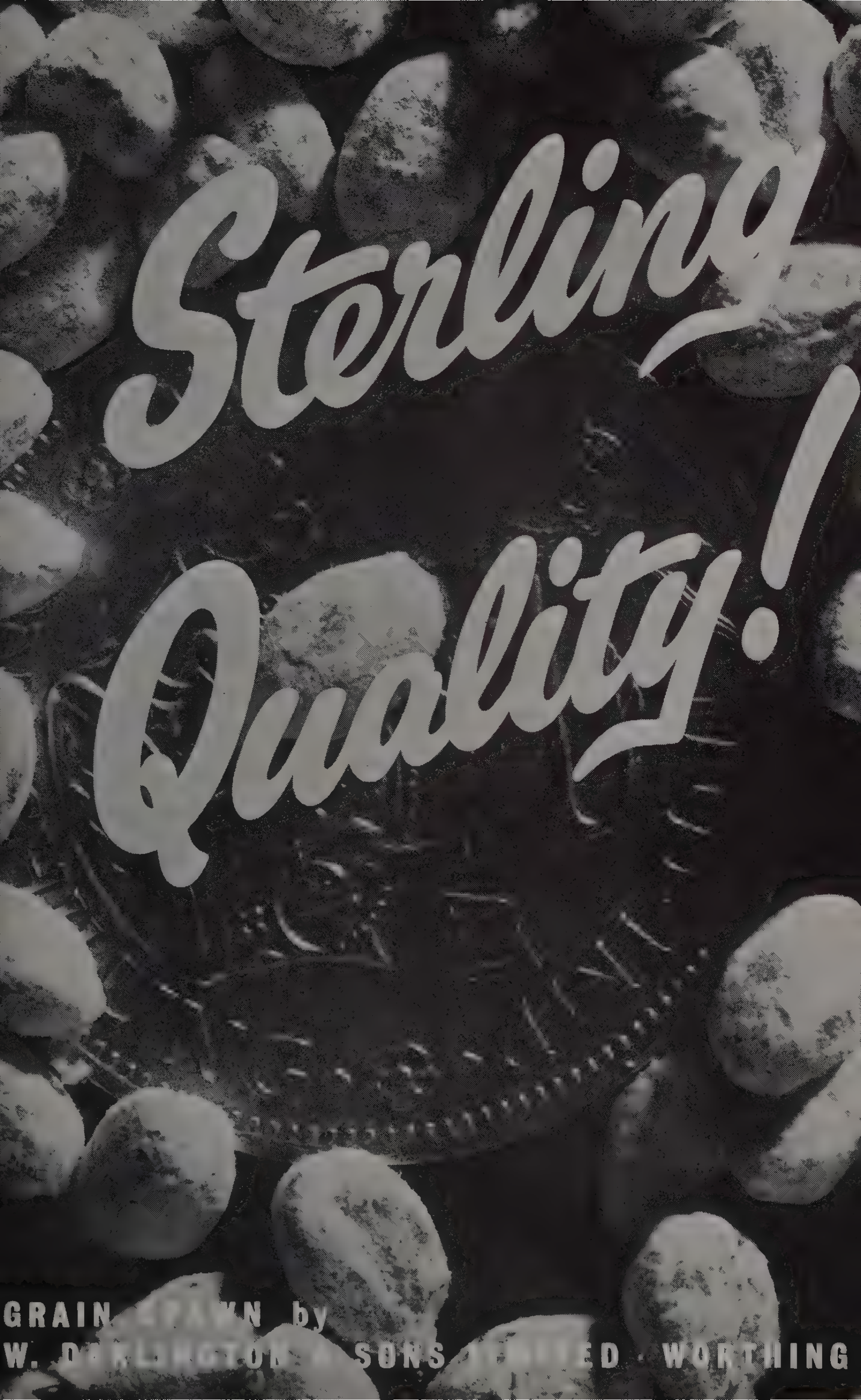
Comments. The r values given for Ardor and Alfol products are for one thickness of the material, and not 1″. Thus, Alfol consists of aluminium-surfaced cardboard, and Ardor of corrugated and flat aluminium sheeting fastened together.

It will be noted that although Fibreglass 4″ House Insulation is the cheapest, one may only buy the 4″ thickness—i.e., one must pay nearly 5d. per square foot!

The table does not deal with the cost of fixing these materials, or with the cost of delivery, the prices being for the London area.

The following list will provide a means to further information on the materials, and gives, incidentally, the firms from which most of the facts for this article have come:—

Alfol.	Alfol Insulation Ltd., 68 Victoria Street, S.W.1.
Ardor.	Ardor Insulation Co. Ltd., Crabtree Manor Way, Belvedere, Kent.
Cork Board.	The Cork Board Information and Research Bureau, 10 Leigham Hall Parade, Streatham High Street, S.W.16.
Fibreglass.	Wiggins Sankey Ltd., Lysia Street, S.W.6.
Isoflex.	BX Plastics, Larkwood Works, Higham Station Avenue, South Chingford, E.4.
Onazote.	The Expanded Rubber Company, 675 Mitcham Road, Croydon.
Woodwool.	The Marley Tile Co. Ltd., London Road, Riverhead, Sevenoaks, Kent.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TOP-DRESSING TURF

by

R. B. DAWSON

The Report of the Horticultural Education Association's Spring Conference in 1953 contains a reference to the use of mushroom compost as a top dressing for turf. The Editor asked the Director of the Sports Turf Research Institute at St. Ives Research Station, Bingley, Yorkshire, to amplify the note for the MGA Bulletin.

There is nothing very definite that I can tell you but it should be appreciated that it is a very common practice in the maintenance of fine turf to use top-dressing materials containing organic matter. Often these are made by building compost heaps of soil and manure and allowing the latter to decompose in conjunction with the soil. The whole material is then broken up and screened through perhaps a $\frac{1}{4}''$ or $\frac{3}{16}''$ sieve. This material can be applied directly to the turf or it can be used for diluting compound fertilizers. A number of clubs have utilised spent mushroom manure in conjunction with this process of top-dressing. Some clubs have been able to obtain the material and use it direct; others have obtained it and included it in a compost heap for further decomposition.

Some of the mushroom manures contain rather too much strawy matter or at least it is not adequately decomposed and so a further period of rotting is in these cases desirable. In using such mushroom manures sometimes trouble has been experienced from the casing soil which can be very harmful as I believe it is the custom to use second spit soil which for our purpose might contain too much clay. We have always been rather concerned as to whether mushrooms would be introduced in to the turf by using the material but I must say we have not had any positive evidence of this as yet.

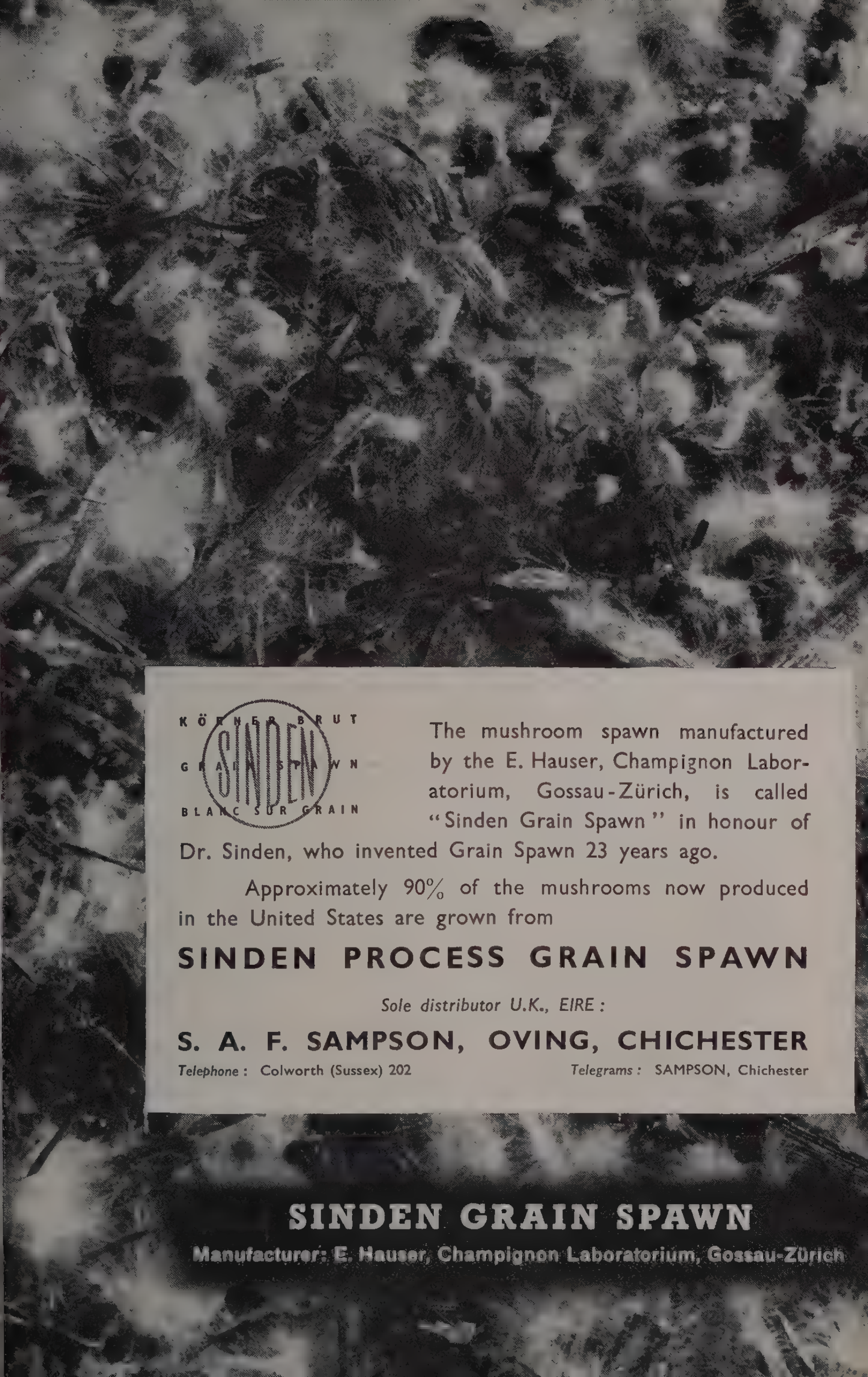
We have a few small experimental plots under observation at the Station. There is nothing outstanding about them and the results obtained would be just similar to those obtained with any normal type of compost such as described earlier in this letter. I think that provided the material can be obtained at reasonable cost there is a use for it in turf maintenance but, of course, it is not the be all and end all of turf management. **None of our clubs is at all interested in buying material with a fancy price on the assumption that the material has some special properties.**

I think this gives you a general summary of the position and I hope it will be of interest.

WHOSE MONEY?

A recent court decision following the liquidation of John Thwaites (London) Ltd. may have far reaching implications. Growers who had sent produce on commission to the company are not to be treated as preferential creditors . . . . . . NFU legal experts are discussing this question with the Ministry of Agriculture.

The Grower, 20.2.54.



The mushroom spawn manufactured by the E. Hauser, Champignon Laboratorium, Gossau-Zürich, is called "Sinden Grain Spawn" in honour of Dr. Sinden, who invented Grain Spawn 23 years ago.
Approximately 90% of the mushrooms now produced in the United States are grown from
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Telegrams: SAMPSON, Chichester
SINDEN GRAIN SPAWN
Manufacturer: E. Hauser, Champignon Laboratorium, Gossau-Zürich

FRENCH EXPORTS

French exports of mushrooms in 1953 (reported in the Bulletin of the French Mushroom Growers Federation) were equivalent to about 11 million lb. of fresh mushrooms. Over 95% of this total was canned, about ⅓% pickled in barrels, and the rest (500,000 lb.) fresh.

These exports form about a quarter of the total mushrooms produced in France, and include half of the quantity canned there.

Compared with 1952, these figures represent a decrease of 35% in exports of fresh mushrooms, and an increase of 18% in canned form; both of these tendencies were already apparent in recent years.

Their principal markets were:	1952	1953
For **canned** mushrooms :	lb.	lb.
U.S.A.	1,460,000	2,700,000
Switzerland	740,000	960,000
Belgium and Luxembourg	657,000	626,000
British Malaya	724,000	549,000
Sweden	167,000	400,000
Hong Kong	88,000	237,000
Germany	164,000	222,000
Belgian Congo	206,000	197,000
Great Britain	154,000	185,000
Canada	338,000	173,000
And for **fresh** mushrooms:		
U.S. occupation forces in Germany	288,000	127,000
Belgium and Luxembourg	70,000	68,000
Great Britain	116,000	67,500
Switzerland	43,000	36,000

The figures given for the total values of their exports correspond to an average price of 2s. 9d. per lb. for fresh, 2s. 3d. for canned, and 3s. 6d. for pickled mushrooms in 1953, (3s. 0½d., 2s. 1½d., and 3s. 0d. respectively in 1952). It is not stated whether these are the prices actually received by the growers.

The stability of their mushroom industry is obviously very dependent on their exports of canned mushrooms, particularly to U.S.A.

PRESS CUTTINGS

You need to know all about it (mushroom growing) before starting, as it is **a skilled business.**

MARIAN CUTLER in *London Star*, 31.12.51.

The minds of the synthetic pundits are methodical and mechanical. They must have everything cut and dried* beforehand . . . . . . No snags or delays must upset the synthetic man's scheme of things. I wonder whether it works out in practice.

ROBERT PATTERSON in *The Commercial Grower*, 12.2.54.

*On the contrary, so far as the straw is concerned!—F.C.A.

A University of Florida report of the growth of the mycelium of *Agaricus blazei* in submerged culture on orange juice, citrus press H_2O, and synthetic media, is given in the *Journal of Agricultural Food Chemistry* 1 (1953). It reveals that this mycelium, when prepared as a food, lacks the true mushroom flavour.

In France, **micro-tools** are used by one firm to develop larger and more flavourful strains of mushrooms. A clump of 100,000 of the threadlike spores from which mushrooms are germinated makes a tiny speck on a microscope slide. Armed with a micro-fork, the mushroom grower probes into the cluster, spreading it out the way a farmer spreads out a hayrick. He selects the larger and more vigorous spores and from them starts new cultures.

CURIEUX (Switzerland), 14.3.51.

This industry is now being offered a number of very powerful substances and the dosages are often calculated in " parts per million " of the active principle in water . . . . . . Really accurate measurement must be important . . . . . . The 20-ounce or 2-ounce **measuring glass** can be bought at most chemists but they soon come to grief . . . . . . Could these not be made in plastic ware for us ?

LESLIE CLARK in *Essex Farmers' Journal*, 1951.

A vigorous approach by area boards to the development of **electricity supplies** in rural areas was urged by the president of the N.F.U., Sir James Turner, when he proposed the main toast at the annual luncheon of the Electrical Development Association in London . . . . . . The area boards, said Sir James, tended to think regionally rather than nationally, which was clearly contrary to the 1947 Electricity Act. The N.F.U. were concerned that there should be a single national policy on such vital matters as connection and charges tariffs. The N.F.U. disagreed with the levying of capital contributions for connecting farms and found line rental equally unacceptable.

County Gentlemen's Association's *Estate Magazine*, June, 1951.

Nor am I happy at the suggestion that the cost of heating a glasshouse electrically can be of the same order as that for using solid fuel. If the same temperature is to be maintained, **electrical costs** will most definitely be higher.

C. A. CAMERON BROWN in *Fruit Grower*, 3.1.52.

SMALL ADVERTISEMENTS (3d. a word)

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Tib 132e

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